

National Aeronautics and Space Administration



# **NASA's In-Situ Resource Utilization Project Project Status for FY12 & Beyond**

**William E. Larson  
ISRU Technology Development Project Manager**

**June 20, 2011**

[www.nasa.gov/exploration](http://www.nasa.gov/exploration)

# Topics



- What a Difference a Year Makes
- FY11 Activities Year to Date
- A New Program Model
- Opportunities for External Participation
- In-House FY12-14 Technical Content(Based on the President's Budget)
- Fight Opportunity?

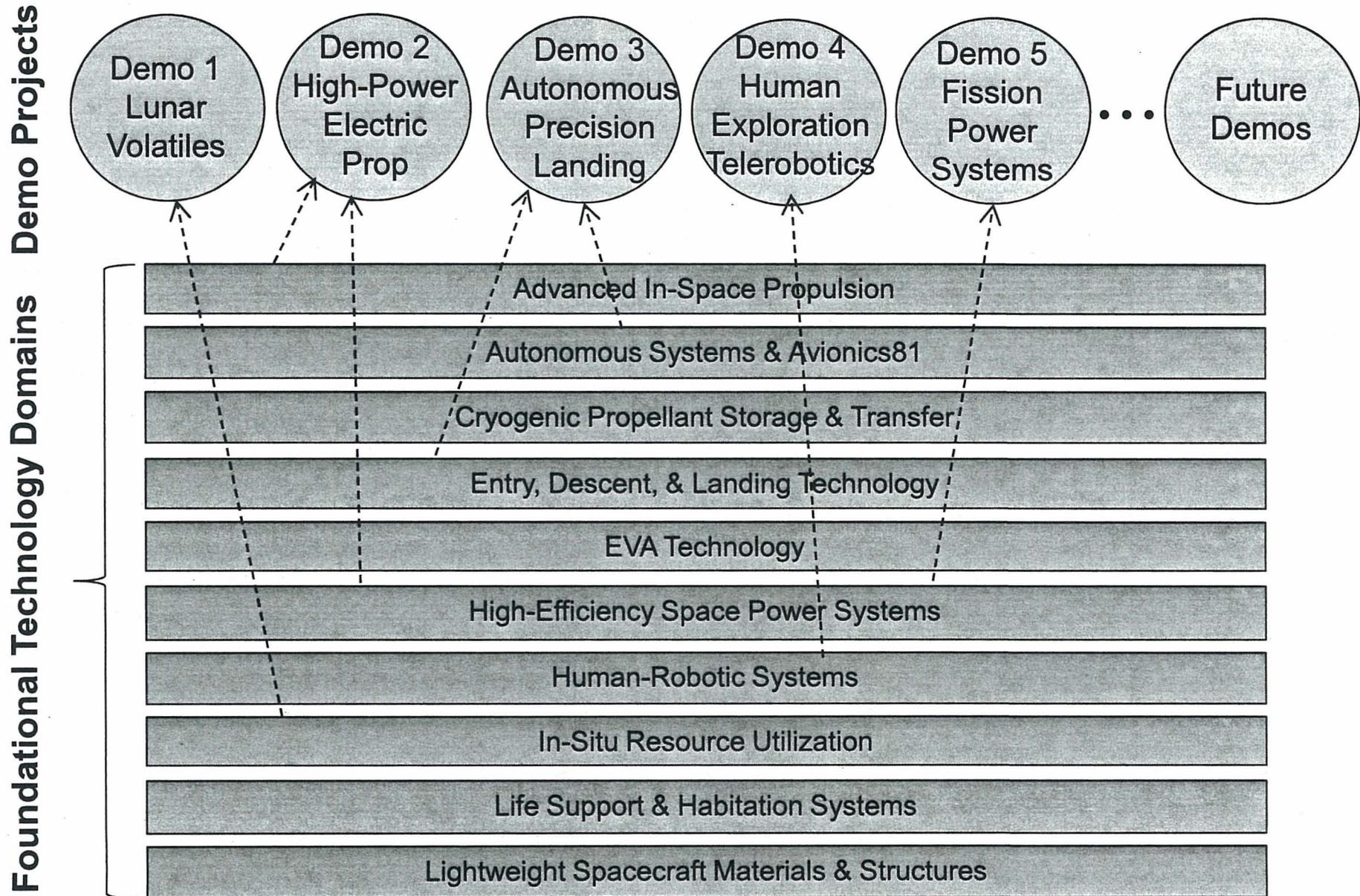
# That Was Then, This Is Now...



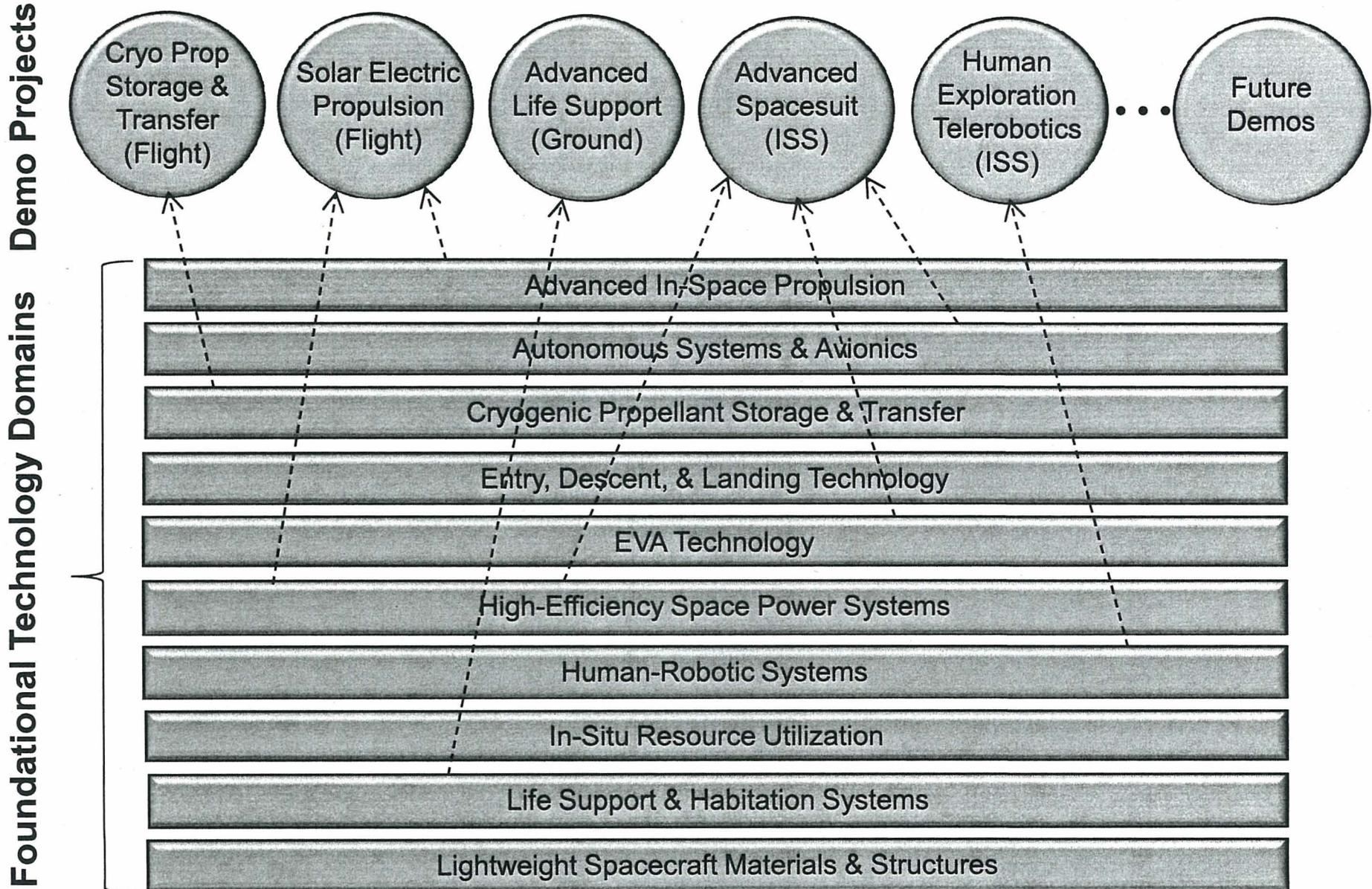
- Last year you were told:
  - NASA would have a new focus on technology development first, then human exploration second.
  - As an Executive Branch Agency, NASA was responsible for developing a plan to execute the President's proposed budget (and we did)
  - NASA established Study Teams to flesh out the new programs and plan content for FY11 and beyond
    - Robotic Precursors, Flagship Demonstrations, Enabling Technology Dev & Demonstration, Space Technology Program, Heavy Lift Propulsion, Participatory Exploration, Human Research Program
- Where we are now:
  - The budget Congress passed didn't provide the money needed to stand up all of the Study Team Programs.
    - Programs Directly Affecting ISRU:
      - Robotic Precursors Flagships & Enabling Technology were folded together into one Program with a drastically reduced budget, Space Technology hasn't officially been started, though they have been allowed some limited FY11 funding.
      - Robotic Precursors is now limited to a small satellite program, Flagships projects have been seriously reduced in scope & Enabling Technology lost virtually all of it's demonstration projects.



# Planned FY11 Program Structure



# Actual FY11 Program Structure

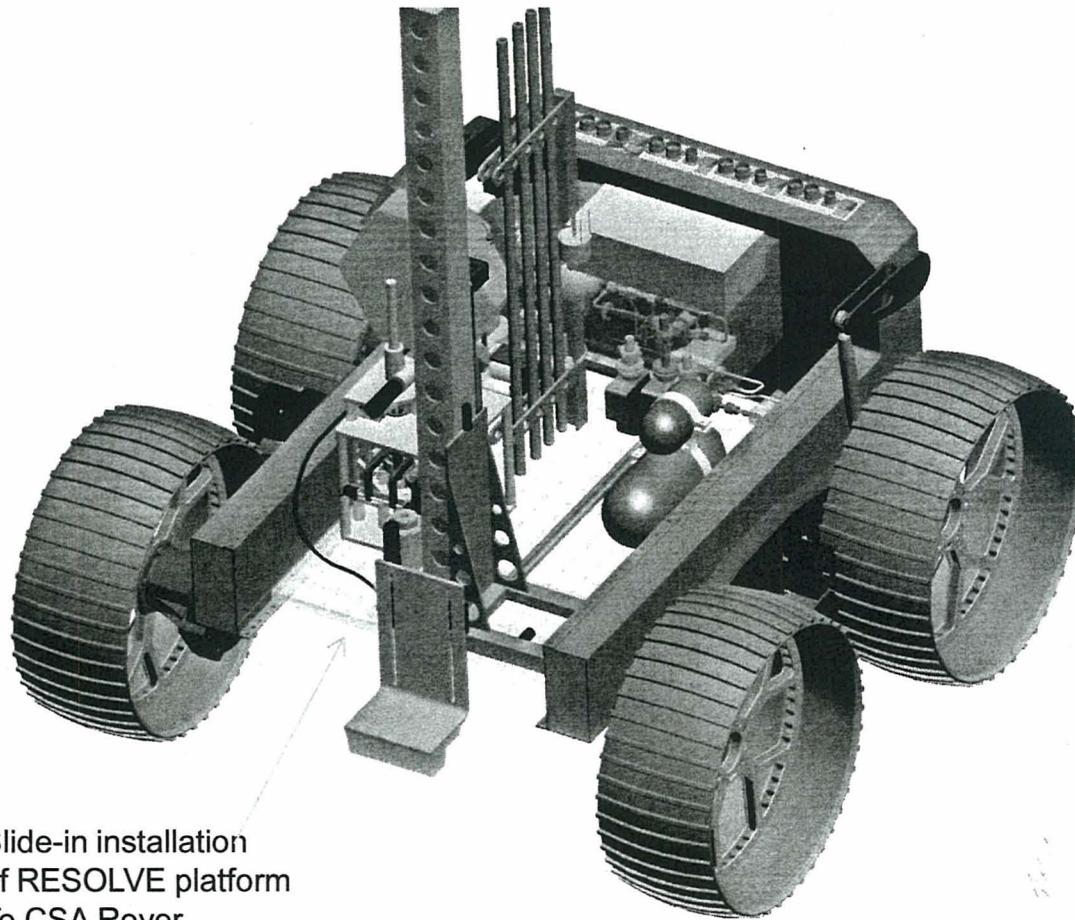


# ISRU FY 11 Projects Progress



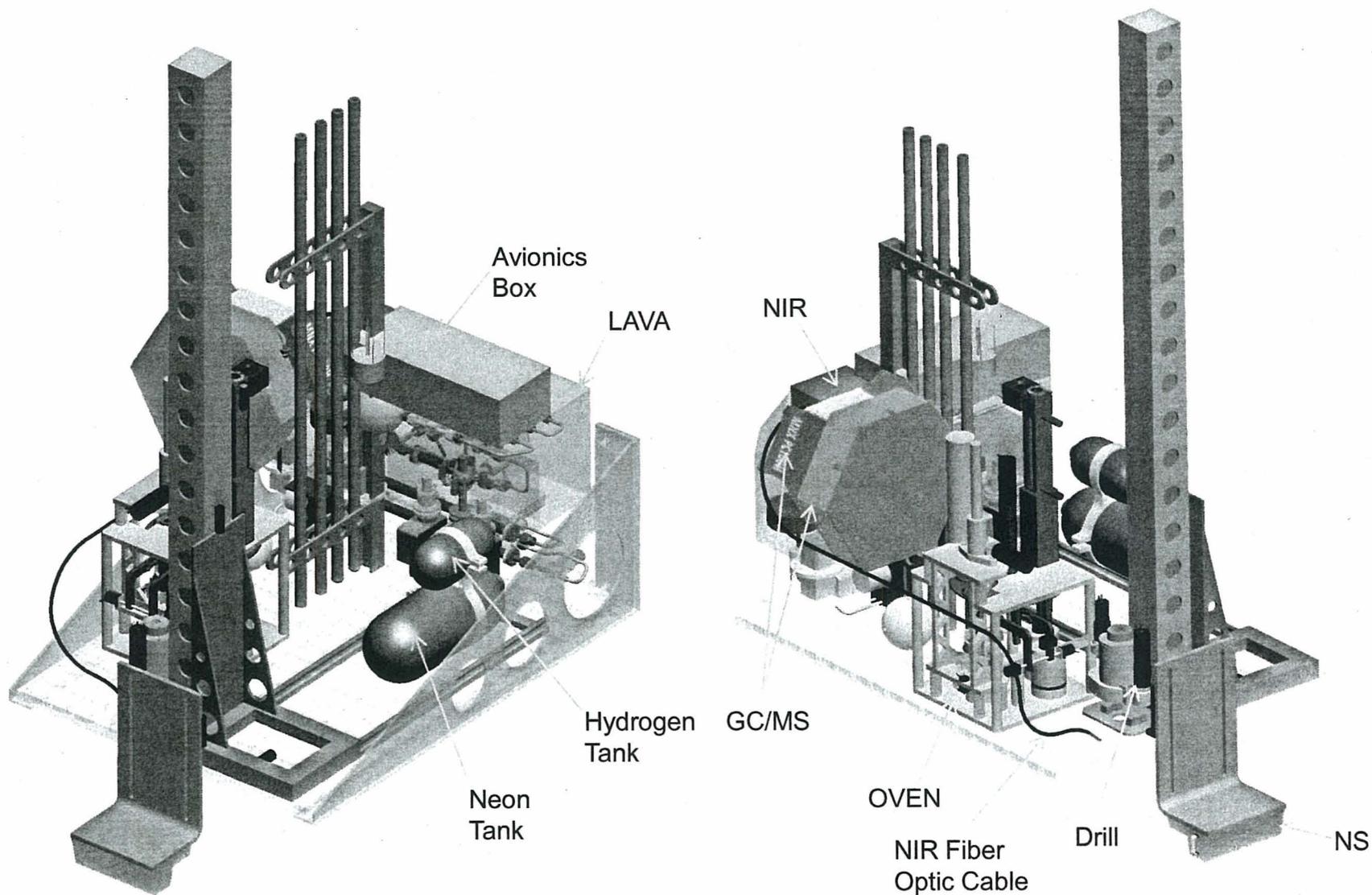
- Due to the Program restructuring, the ISRU domain and the Lunar Volatiles Demonstration project, RESOLVE were merged.
  - This meant that we could not pursue all of the technology development that we wanted to, but we still manage to maintain a reasonably diversified portfolio.
  - RESOLVE took a big hit in this restructuring, but through some creative project management we've been able to maintain progress on RESOLVE.
- Domain Activities underway
  - RESOLVE: Lunar Water Prospecting
  - Mars Water Extraction From Regolith
  - Trash Processing For Fuel & Water Production
  - Regenerable Mars Dust Filtration
  - Atmospheric Capture & Gas Separation Membranes
  - Regenerable Water Clean Up Systems
  - Regolith Feed/Delivery Systems
  - Analytical Models Of ISRU Systems

# CSA Resolve Rover

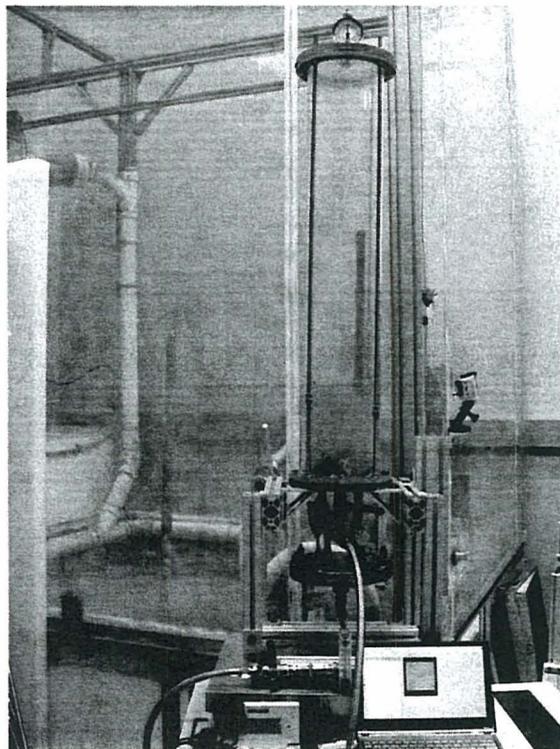


Slide-in installation  
of RESOLVE platform  
To CSA Rover

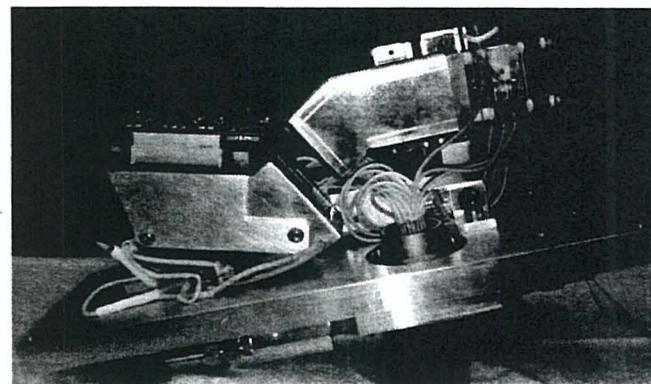
# RESOLVE Payload



# FY11 Activities Year-To-Date

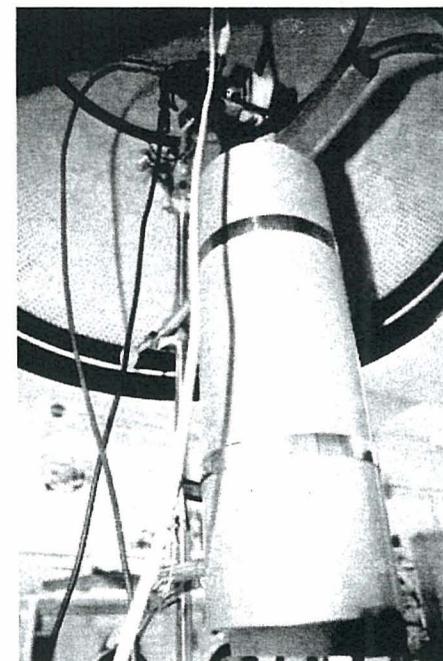


Pneumatic Feed System Test Apparatus

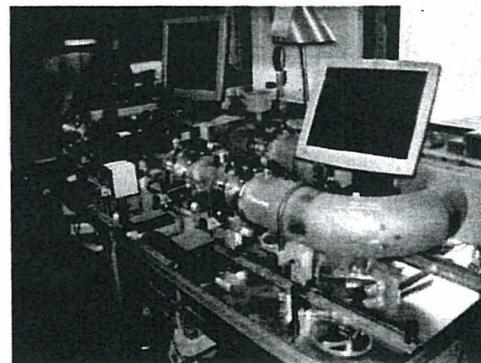


GC/MS Instrument for RESOLVE, configured for checkout test of water detection

Electrostatic Precipitator Test Apparatus



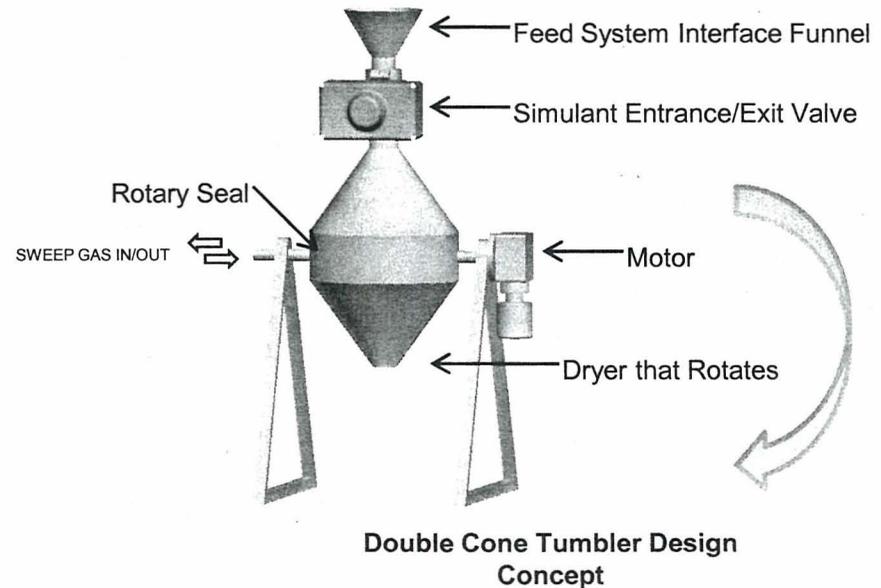
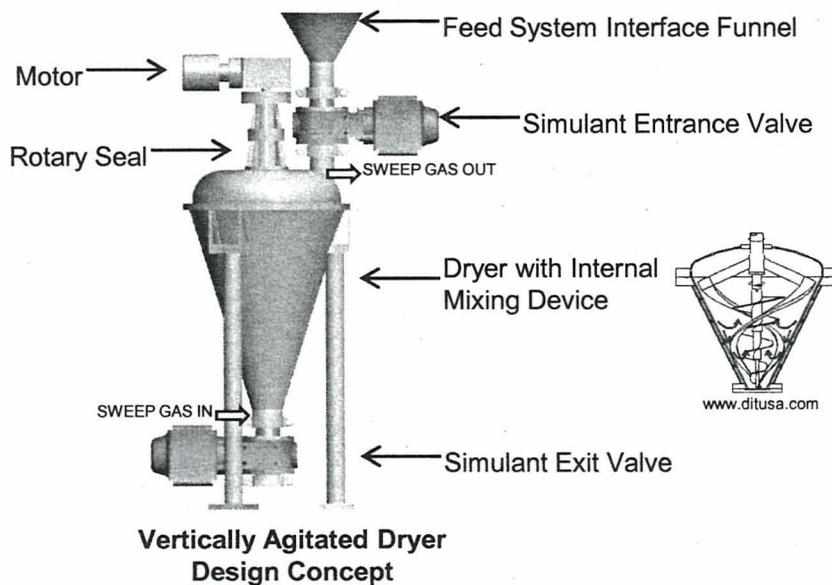
Filtration Testing Facility



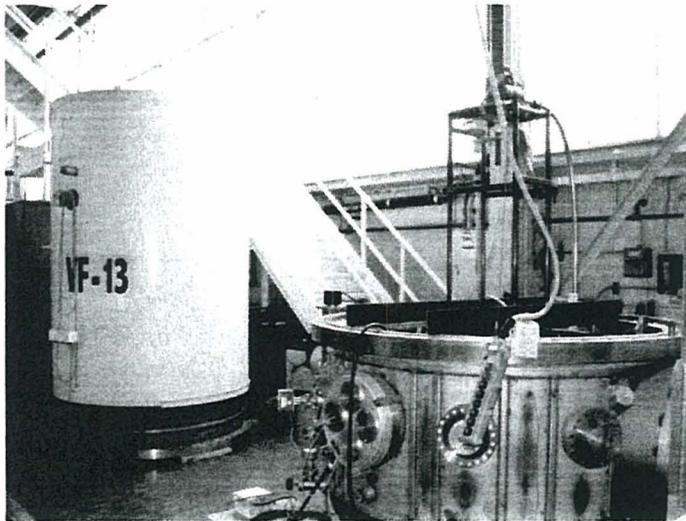
# Mars Water Extraction



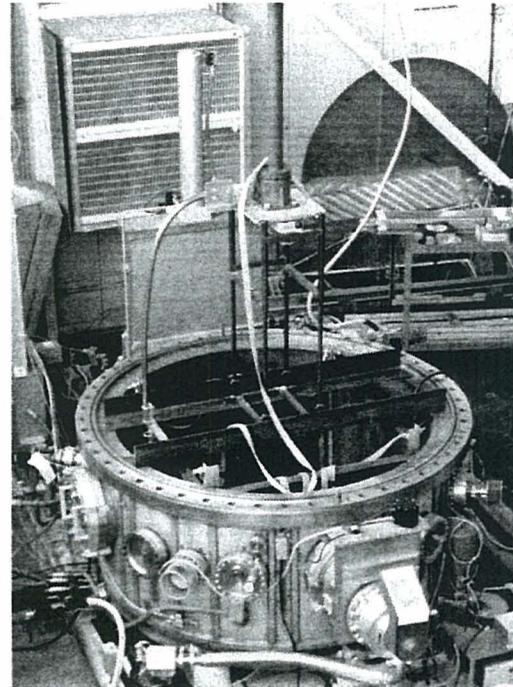
- Mars Soil Dryer
  - Two soil dryer options were presented at PDR. These two main options were selected from an initial list of 12.
  - The two options are a vertically agitated dryer and a double cone tumbler.
  - Both options will be engineered further, with a down select occurring soon



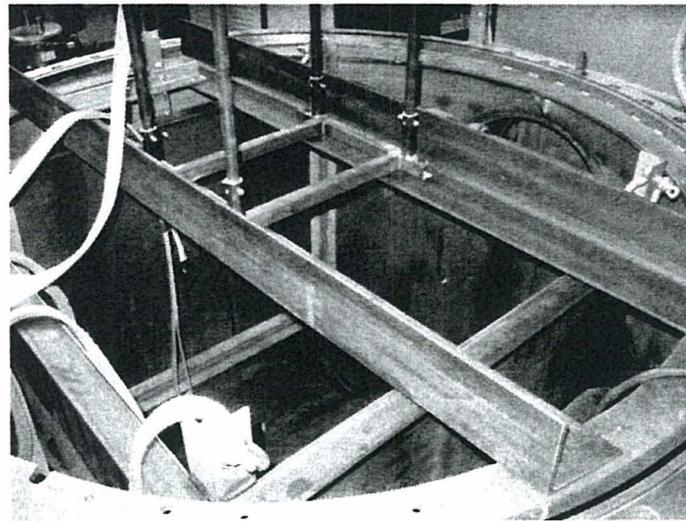
# Soil Compaction In A Vacuum Chamber



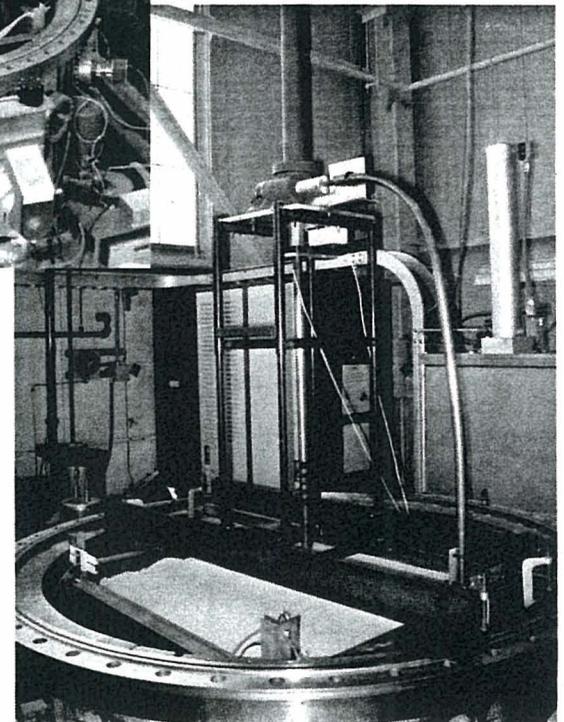
Cone Penetrometer load frame w/ top hat



CPT w/ empty soil bin in chamber



CPT load frame w/ empty soil bin in chamber



CPT w/ filled soil bin in chamber

# A New Program Model for FY12



- Both the Office of Chief Technologist and the Exploration Directorate will fund ISRU related activities in FY12
  - Office of Chief Technologist Plans A Different Approach For NASA “Guided” work.
  - OCT guided work will be focused on one projectized activity only.
  - Other ISRU activities will be determined by a new Principal Investigator assigned at HQ
    - PI will chose technical direction and the amount of ISRU investment
  - For FY12 & 13 OCT has asked us to develop a reactor that would form the basis of either a oxygen production demonstration mission or a lunar volatiles prospecting mission.
- ESMD decided to stand up a new internal activity named Advanced Exploration Systems (AES) primarily because of workforce that was available due to the retirement of Shuttle.
  - Under AES the ISRU team to continue the development of RESOLVE, our lunar volatiles prospecting payload and to perform a field test at a lunar analog in 2012.
  - Uses the reactor that OCT is paying for and adds the other elements of RESOLVE (water capture, GC/MS, Sample Acquisition, etc.)
- A real concern with this model is how the Agency will preserve capabilities not required for RESOLVE or the O2 reactor.

# Opportunities for External Participation



- OCT still wants to compete a significant portion of their technology portfolio.
- NASA has requested an FY11 Operating Plan modification that would allow OCT to be officially “stood up” and would give them funding through the end of this FY and more importantly next FY.
- The ISRU PI at HQ will make the final decisions on the proposal call’s scope.
  - I’m hopeful that the current ISRU team will have influence in the scope definition process.
- I would expect Broad Area Announcements to hit the streets sometime in July if the Op Plan change is approved.

# Flight Opportunities



- There are several paths to flight for ISRU that appear to be open to the community.
- OCT may solicit for the development of an O<sub>2</sub> Production Payload built around the Reactor NASA is building in-house
- OCT may also issue a solicitation (probably in FY12 at the earliest) for the development of a demonstration mission for ISRU.
  - Mission could possibly utilize Google X-Prize participants
  - Mission could be based around the Morpheus Lunar Lander that JSC is building in-house
  - Mission could be something out of the box all together
- Not a clear picture at all, but at least we are finally talking about flying ISRU no later than the middle of this decade.

# Conclusion



- The last couple of years have been very turbulent
- A clearer picture of the ISRU technology development future is beginning to emerge.
- There are still some problems with the implementation with respect to maintaining in-house capability
- Along with these concerns there is a lot of Good news
  - We have two ISRU payloads in development.
  - We have flight opportunities
  - The external community should have an opportunity participate
    - The NASA ISRU Team would love to collaborate with you, so don't forget us.
- Hang in there and stay alert for the opportunities as the emerge